

# **Housing and Commuting: The Theory of Urban Residential Structure**

**an e-book  
by John Yinger**

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## **Chapter 1.1: Introduction April 2005**

**This e-book compiles my graduate teaching notes and journal publications on the theory of urban residential structure. It is set up to be a Ph.D.-level textbook in urban economics.**

**This book has five parts: The basic urban model; the urban transportation system; sorting and labor markets; racial and ethnic prejudice and discrimination; and urban public finance.**

**The first part contains three substantive chapters. Chapter 1.2, “Introduction to Urban Models,” which was originally written for a master’s class, provides an intuitive introduction to the main concepts in urban models. Chapter 1.3, “The Basic Urban Model,” presents a standard mathematical model of urban spatial structure in great detail. It discusses the assumptions, derivations, and comparative static results for the model that forms the foundation of the field of urban economics. The other parts of the book provide models with alternative, more general assumptions. Chapter 1.3 includes exercises and suggestions for further reading. Yinger (1976a), which is not available on the internet, tests the central results of an urban model using theoretically derived functional forms. Although many empirical studies examine these results, which link house values (or land rents) with distance from a worksite, these other studies do not use**

specifications derived from the theory of urban residential structure. This study is summarized at the end of Chapter 1.3.<sup>1</sup>

The spatial dimension of an urban model depends directly on the model's assumptions about the transportation system that takes commuters from their homes to their jobs. Part 2 of this e-book considers several alternative assumptions about this urban transportation system. The standard urban model, that is, the model presented in Chapter 1.3, assumes that the transportation system consists of a large number of radial highways. Chapter 2.1, "Around the Block: Urban Models with a Street Grid," solves urban models with a wide variety of alternative transportation networks, including a street grid and a slow-speed grid combined with commuting arteries. This chapter also shows that empirical tests of urban model results typically yield biased results if they are based on straight-line distance between residence and worksite.

Chapter 2.2 solves an urban model with congestion. Previous congestion models make the same assumption as a standard urban model, namely that there is a dense network of radial highways. This chapter introduces congestion into a model based on the assumptions that there is a commuting artery and a street grid and that people commute to work in cohorts. Finally, Chapter 2.3, "Timing Equilibria in an Urban Model with Congestion," which was co-authored with Stephen Ross, shows that all existing urban models with congestion, including the one in Chapter 2.2, require strong assumptions about the timing of work trips in order to reach an equilibrium. This chapter also provides suggestions for devising more satisfactory congestion models.

The third part of this e-book examines models that generalize three key assumptions in the standard urban models: (1) there is only one income-taste class, (2) there is only one worksite, and (3) the demand for labor (in the production of the export good) is infinitely elastic.<sup>2</sup>

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<sup>1</sup> One might ask whether the basic urban model describes an efficient allocation of resources, a question first posed in a well-known article by Mirrlees (1972). Yinger (1992) provides an alternative treatment of the efficiency of urban residential structure and uses this analysis to show that racial residential integration may be efficient under many circumstances, even when it does not arise without government intervention.

<sup>2</sup> Another key assumption is that distance to work is the only locational characteristic of housing that people care about. Yinger (1976b) generalizes this assumption by introducing a neighborhood amenity into an urban model. The particular amenity in this article is racial composition, which matters to people with prejudice, but the approach can be applied to other amenities as well. This article first appeared in the same year as well-known article with a general treatment of amenities, namely, Polinsky and Shavell (1976). Yinger (1976b) models amenities as a component of housing services, not as a component of housing prices. Given the multiplicative functional forms in the paper, these two approaches are equivalent, but I now think, as do most other urban scholars, that it is more appropriate to treat racial composition, or any other neighborhood amenity, as component of housing price. Housing services reflect the characteristics of a housing unit and it lot; housing prices reflect characteristics of a housing unit's location.

**Chapter 3.1, “An Equilibrium Model of Urban Population and the Distribution of Income,”** co-authored Sheldon Danziger, introduces more than one income class into an urban model.<sup>3</sup> **Chapter 3.2, “Comparative Static Analysis of Open Urban Models with a Full Labor Market and Suburban Employment,”** co-authored with Stephen Ross, introduces a full labor market into an urban model, that is, it determines the wage based on the supply of workers and the demand for workers in the production of an export good. This model is solved both with and without a suburban business district. This chapter builds on Yinger (1993), which is not available on the internet. This article solves an urban model with both a central business district and a suburban business district. It assumes that the transportation network consists of circular streets combined with one straight-line commuting artery through the CBD. A model with a suburban business district and a street grid is solved in Chapter 2.1.

Standard urban models do not consider the issue of inter-group prejudice and discrimination. The impacts of prejudice and discrimination on urban residential structure are considered in Yinger (1976b) and Courant and Yinger (1977), which are not available on the internet. The importance of this issue (and of these models) obviously depends on the extent to which prejudice and discrimination continue to exist. The fourth part of this book therefore presents several of my recent articles, most of which are co-authored, that examine the measurement, causes, and consequences of racial and ethnic discrimination in housing. Additional material on these topics can be found in Ross and Yinger (2002), Yinger (1995), and Yinger et al. (2005).

**Chapter 4.1, “Measuring Racial Discrimination with Fair Housing Audits: Caught in the Act,”** develops an econometric framework for studying discrimination with fair housing audits and presents results for discrimination in the number of housing units shown based on audits conducted in Boston in 1981. **Chapter 4.2, “Cash in Your Face: The Cost of Racial and Ethnic Discrimination in Housing,”** measures the monetary cost of housing discrimination by calculating the loss in consumer surplus it imposes on the households that encounter it. **Chapter 4.3, “Evidence on Discrimination in Consumer Markets,”** presents a review of the literature on discrimination in housing, automobile sales, and other consumer markets.

The next two chapters in this part examine the causes of discrimination in housing using the 1989 Housing Discrimination Study, which collected information on discrimination around the country using the fair housing audit technique. These chapters, both of which are co-

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<sup>3</sup> A more elegant and complete analysis of urban models with more than one income-taste class is provided by Hartwick, Schweitzer, and Variaya (1976).

authored with Jan Ondrich and Stephen Ross, treat a housing unit, not an audit, as the unit of observation. Instead of investigating the circumstances under which a minority auditor is treated less favorably than his or her majority teammate, these chapters investigate the circumstances under which a particular housing unit is shown to both auditors, to the majority auditor only, or to the minority auditor. Chapter 4.4, "Geography of Housing Discrimination" uses this technique to study to spatial dimension of discrimination in five urban areas. Chapter 4.5, "Now You See It, Now You Don't: Why Do Real Estate Agents Withhold Houses from Black Customers?" applies this technique to the full HDS 1989 sample and asks whether discrimination depends on the match between a housing unit and the unit initially requested by the customer.

The final two chapters in this part study the causes of discrimination using the 2000 Housing Discrimination Study, which also is based on national audit data. Both of these chapters focus on discrimination in discrete actions by landlords, such as the decision to show an advertised unit to a customer, and both chapters make use of the fixed-effects logit technique. Chapter 4.6, "Do Rental Agents Discriminate Against Minority Customers? Evidence from the 2000 Housing Discrimination Study," which is co-authored with Seok Joon Choi and Jan Ondrich, focuses on the rental market and chapter 4.7, "Why Do Real Estate Brokers Continue to Discriminate? Evidence from the 2000 Housing Discrimination Study," which is co-authored with Bo Zhao and Jan Ondrich, focuses on the sales market.

Part 5 of this book adds local governments. Ross and Yinger (1999) provides a comprehensive review of the literature on urban public finance. Although this chapter is not available on the internet, a significant share of the material in it is covered by the chapters in this part of this book. Chapter 5.1, "Capitalization and the Theory of Local Public Finance," derives expressions for the impact of public services and taxes on house values and discusses the sorting of households across communities. As discussed in Ross and Yinger (1999), similar expressions have appeared in many other articles in the literature. The sorting discussion in this paper is revised in Chapter 5.2, "Capitalization and Sorting: A Revision." The implications of sorting for the efficiency of a system of local governments are discussed in Yinger (1999) and Ross and Yinger (1999)

Chapter 5.3, "Bidding and Sorting," provides an overview of the literature on the selection of a community (which is also the subject of Chapters 5.1 and 5.2). This chapter, which builds on notes prepared for a master's level public finance class, presents the basic graphs needed to understand the theory of bidding and sorting, but does not contain formal mathematical derivations. One of the key implications of this theory is that property taxes will be capitalized into house values, that is, that people will

bid more for a house with it has a lower effective property tax rate, all else equal. Chapter 5.4, "Property Tax Capitalization," provides an overview of the literature, both conceptual and empirical, on this topic. It is based on notes prepared for a Ph.D. seminar in public finance and draws heavily on Yinger, et al. (1988).

## References

- Courant, Paul N., and John Yinger. 1977. "On Models of Racial Prejudice and Urban Residential Structure." *Journal of Urban Economics*, July, pp. 272-291.
- Hartwick, John, U. Schweizer, and P. Varaiya. 1976. "Comparative Statics of a Residential Economy with Several Classes." *Journal of Economic Theory*, pp. 396-413.
- Mirrlees, James A. 1972. "The Optimum Town." *Swedish Journal of Economics*, 74 (1), pp. 114-135.
- Polinsky, A. Mitchell and Stephen Shavell. 1976. "Amenities and Property Values in a Model of an Urban Area." *Journal of Public Economics*, January/February, pp. 119-130.
- Ross, Stephen, and John Yinger. 1999. "Sorting and Voting: A Review of the Literature on Urban Public Finance." In *Handbook of Urban and Regional Economics, Volume 3, Applied Urban Economics*, edited by P. Cheshire and E. S. Mills (Amsterdam: North-Holland), pp. 2001-2060.
- Ross, Stephen L., and John Yinger. 2002. *The Color of Credit: Mortgage Lending Discrimination, Research Methodology, and Fair-Lending Enforcement*. Cambridge, MA: MIT Press.
- Yinger, John. 1976a. "Estimating the Relationship Between Location and the Price of Housing." *Journal of Regional Science*, August, pp. 271-289.
- Yinger, John. 1976b. "Racial Prejudice and Racial Residential Segregation in an Urban Model." *Journal of Urban Economics*, October, pp. 383-396.
- Yinger, John. 1992. "An Analysis of the Efficiency of Urban Residential Structure, with an Application to Racial Integration." *Journal of Urban Economics*, May, pp. 388-407.
- Yinger, John. 1993. "City and Suburb: Urban Models with More Than One Employment Center." *Journal of Urban Economics*, March, pp. 181-205.
- Yinger, John. 1995. *Closed Doors, Opportunities Lost: The Continuing Costs of Housing Discrimination*. New York: Russell Sage Foundation.

Yinger, John. 1999. "Capitalization and Efficiency." In *Environmental and Public Economics: Essays in Honor of W. E. Oates*, edited by A. Panagariya, P. Portney, and R. Schwab (Cheltenham, UK: Edward Elgar), pp. 310-326.

Yinger, John, with contributions by Seok Joon Choi, Jan Ondrich, Stephen Ross, Alex Stricker, and Bo Zhao. 2005. *Why Housing Agents Discriminate: The Measurement, Causes, and Consequences of Housing Discrimination*. An e-book posted at <http://faculty.maxwell.syr.edu/jyinger>, version 1.0, March.

Yinger, John, Howard S. Bloom, Axel Boersch-Supan, and Helen F. Ladd. 1988. *Property Taxes and House Values: The Theory and Estimation of Intra-jurisdictional Property Tax Capitalization*. Boston: Academic Press.